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AUTHOR Bryant, Veronica A.
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ABSTRACT

This documents presents a practicum designed to improve mathematics achievement of at-risk and targeted students in grades 4-6 in an upper-middle class suburban community through the use of manipulatives. The primary goal was to provide mathematics manipulatives to teachers that would assist in helping at-risk and targeted students. A secondary goal was to offer teachers and parents other strategies to help the identified at-risk and targeted students. An inservice workshop was conducted to familiarize teachers with teacher-made mathematics manipulatives and strategies that would be used during an 8-month implementation period. Monthly memos, peer tutors, computers, bulletin boards, morning math activities, and parent and teacher surveys were also used. There were 5 behavioral objectives to be attained by at least half of the 65 at-risk and targeted students of the study at the end of the 8-month implementation of the practicum: (1) improvement on students' 1990-1991 and 1991-1992 Program of Studies (POS) scores; (2) improvement on their second and fourth quarter report card grades; (3) improvement on data collected from the end of year survey; (4) improvement in use of mathematics manipulatives; and (5) 4 out of 7 teachers would be able to use mathematics manipulatives to effectively help at-risk and targeted students in identified mathematics objectives. Comparisons of the POS scores and students' grades indicated an increase in test scores and letter grades. Parent surveys collected corroborated the success of the students' progress and use of manipulatives. The results from the teacher checklists and survey indicated frequent use of manipulatives and other strategies. Appendices include teacher and parent surveys, a list of teacher-made manipulatives, a teacher questionnaire, a quarterly data collection sheet, a strengths and weaknesses table, and a log of unexpected events. (MDH)

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Improving Mathematics Achievement of At-Risk and Targeted Students in Grades 4-6 Through the Use of Manipulatives

by

Veronica A. Bryant

Cluster 32-B

A Practicum Report presented to the
Ed. D. Program in Early and Middle Childhood
in Partial Fulfillment of the Requirements
of the Degree of Doctor of Education

NOVA UNIVERSITY

1992

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PRACTICUM APPROVAL SHEET

This practicum took place as described

Verifier: Kathleen W. Mulcahy

Kathleen W. Mulcahy, Ed.D

Principal, Waynewood School.

1205 Waynewood Boulevard, Alex., VA 22308

September 1, 1992
Date

This practicum report was submitted by Veronica A. Bryant under the direction of the adviser listed below. It was submitted to the Ed.D. program in Early and Middle Childhood and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Nova University.

Approved:

Oct. 23 1992
Date of Final Approval of Report

June S. DeLano
June S.Delano, Ph.D.
Adviser

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ABSTRACT

Improving Mathematics Achievement of At-Risk and Targeted Students in Grades 4-6 Through the Use of Manipulatives. Bryant, Veronica A., 1992: Practicum Report, Nova University, Ed. D. Program in Early and Middle Childhood. Descriptors: Mathematics/Achievement/Academic/Peer Tutor/Learning Disability/Tactile kinethetics/Collaborative Learning/Minority Achievement/Urban Schools/At-Risk Students/Middle Childhood/Computers

This practicum was designed to improve mathematics achievement of at-risk and targeted students in grades 4-6 through the use of manipulatives. The primary goal was to provide math manipulatives to the teachers that would assist in helping at-risk and targeted students. A secondary goal was to offer teachers and parents other strategies to use to help the identified at-risk and targeted students.

The writer was able to conduct an in-service to the teachers to familiarize them with the mathematics manipulatives and strategies that would be used. Monthly memos, peer tutors, computers, bulletin board, morning math activities, and parent and teacher surveys were also used.

There were five objectives in this practicum. The writer administered three surveys, two checklists and compared and contrasted a standardize test to determine if at-risk and targeted students were improving in mathematics through the use of manipulatives. The instruments were used to assist in measuring the outcomes of the five objectives. The results from the comparison and contrast of the 1991-1992 Mathematics Program of Studies (POS) showed an increase in the students' test scores. Second and fourth quarter report card grades indicated an increase in higher letter grades. Parent surveys collected collaborated the success of the students' progress and use of manipulatives. The results from the teacher checklists and survey indicated frequent use of manipulatives and other strategies.

The results of the practicum were positive. The goals and objectives of the practicum were met. An analysis of all objectives revealed mathematics achievement of at-risk and targeted students in grades 4-6 through the use of manipulatives..

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CHAPTER I

INTRODUCTION

Description of Work Setting and Community

The elementary school, which was the setting for this practicum, is located approximately five miles from a large metropolitan area. The school is in an upper middle class community representative of two-parent families and white-collar success.

Initially established in l959, this community was composed originally of military installations, federal workers, and political appointees working in the nearby metropolitan area. Growing private industries have great impact in this community, offering employees homes in an aesthetically beautiful environment conducive to raising families. Because of its proximity to three thriving municipalities that offer a variety of country clubs, marinas, parks, wildlife preserves, recreational facilities, theaters, historical landmarks, and museums, the community affords its residents rich opportunities for leisure and a wealth of cultural experiences .

The school system has a population of l32,980 students. This number represents l3% of all the students in this state. This county's ranking by population is l0th in the country.

The county is geographically large, covering 399 square miles. The school system also has l30 elementary schools, 20 intermediate schools, 3

secondary schools, 20 high schools, 18 special education centers, and 20 alternative schools. The general population of the communities served by this school system is approximately 814,400. Each community has a variety of socioeconomic disparity ranging from low to upper middle class income.

The governance of the school system is by a ten member school board and one student representative representing the different communities. In January 1992, the number increased to 11 school board members, to include representation from the new district. The school board provides for the operation and policy for the system and appoints a superintendent who is directly responsible to it regarding board policies and general operation of the school system. The superintendent is assisted by two deputy superintendents, one associate superintendent, four area superintendents, and nine assistant superintendents. The school system employs 15,456 teachers and support staff. The school system is the largest in the state.

The annual operating budget for the school system is approximately 870 million dollars. The average cost per student is $6,497. Revenues are secured from federal, state, and local sources.

Individual students and groups annually earn honors. These honors are in all academic, extracurricular, and athletic areas held at regional, state, and national competitions. It is noted that 90.5 percent of 1990 high school graduates went on to some form of post secondary education and 71.6 percent of them went on to four-year colleges and universities. This county had 167 seniors selected as semifinalists in the 1990-1991 National Merit Scholarship

program. Students in l990 also averaged 457 in the verbal portion of the Scholastic Achievement Test (SAT) and 5l9 in math for a composite total of 976. This county's scores were significantly higher than the state (895 composite) and national (900 composite) averages.

Writer's Work Setting and Role

The reported median income of the community, which was the setting for this practicum, is estimated at $120,000 with the average price of a single-family home exceeding $225,000 plus. The public school in this community, which boasts that students score above the eightieth percentile on standardized tests in reading and mathematics is the epitome of academic excellence.

According to the Self Study report of l990, 85% of the children who attend this school live in the community. School records show that sixty -seven percent of the sixth graders have completed their entire elementary education at this school. This shows much stability in the neighborhood that is surrounded by a very transient area.

Table 1

Number of years in this School (Including present year) Members of highest grade

Years	Number	Percent
1	12	20
3	8	13
5 or more	41	67
Total	61	100

The remaining 15% of the school's population, which is a blend of multi-ethnic cultures and languages, is bussed from different housing developments within a four mile radius. Their communities consist of moderately priced single-family units, townhouses, condominiums, and apartments. One development is comprised of federally subsidized rental townhouses and/or apartment properties. Many of these parents are blue collar workers and/or recent immigrants working at or below the minimum wage.

Table 2

Population of the School by Ethnic Background

Group	Percentage
White	79.6
African-American	2.4
Hispanic	6.4
Asian or Pacific Islander	11.2
Other	.4
Total	100.0

Within the last five years, the school has emerged as a center for children with learning disabilities. This decision, mandated by PL 94-142, affords an environment that would produce the best academic growth for identified learning disabled students.

The grade level distribution of these learning disabilities classes is one class for first through third grade, one class for fourth and fifth graders, and one class for sixth graders. During the 1991-1992 school year, the upper grade

learning disability students were mainstreamed into the immersion class at grades 4 and 5 and the middle school concept at grade 6. The total number of children serviced in the learning disability program is twenty-nine. Each learning disabilities teacher has a full time instructional assistant.

The school is, also, an English as a Second Language Center school. This school-based program is offered to serve the language-minority students who are the fastest growing minority population in the school system. These students are assisted by two full time ESL teachers and an instructional assistant. When these students are not working with the ESL teachers, the students participate in regular classroom activities.

For the past eleven years, the writer has worked as a classroom teacher at the school. Other than the writer's responsibilities as a teacher of language arts and science in the sixth grade middle school program, the writer is an active member of several committees. These committees are the Teacher Assistance Team (TAT) the Math/Science Committee and the Faculty Advisory Committee (FAC).

The writer's background and training includes a Master of Education in learning disabilities. The writer holds state certification in early childhood, elementary education and special education in several school districts. The writer was awarded merit pay during the 1988-1989 school year. The writer has received two grants from the National Science Foundation for her special interest in the field of science. The writer was nominated for the Washington Post's Agnes Meyer Outstanding Teacher Award for the 1991-1992 school year at

her school.

During the 1990-1991 school year, the writer helped to pilot the Middle School Concept at her school. Over the past three years, the writer has been recognized for serving as a Science coordinator and Mathematics cooperating teacher in her school district. The writer has 20 years of teaching experience.

CHAPTER II

STUDY OF THE PROBLEM

Problem Description

Problems are unique to all environments. There are times that situations, ideas, or plans of action, will surface that disrupt the smooth operation of the school. At this school, at-risk and targeted students matriculating in grades 4-6 were not doing well in identified mathematics objectives.

In 1983-1984 the county's school board established a priority to strengthen the K-12 mathematics and science program. The measure of success of the current county's mathematics program is through standardized tests.

Table 3

Dates of the Mathematics Tests

Grade	Name(s) of Test(s)	Date(s) of Test(s)
Grades 1-6	Program of Studies Math	Spring
Grade 4	Iowa Test of Basic Skills	March
Grade 6	Iowa Test of Basic Skills	January

The revision of the elementary education mathematics program reflects

recent research on the teaching and learning of mathematics and addresses the concerns of recent reports and commissions (see Appendix A). The content strands of the new elementary mathematics program of studies (POS) blend traditional mathematics with an emphasis on the development of mathematical concepts, logical reasoning, and mathematical applications.

Elementary mathematics objectives were developed by classroom teachers under the direction of the mathematics coordinator and in cooperation with the area mathematics specialists. This group of people incorporate state standards of learning objectives for mathematics. The objectives were reviewed and field tested by additional classroom teachers and suggested revisions were incorporated. Prior to approval and implementation, the program was reviewed by elementary administrators, the Department of Student Services and Special Education, and parent representatives.

Creative and critical thinking in math was fostered by the use of instructional techniques and materials. These materials and instructional techniques included brainstorming, computer software, games, oral and written problems, graphs, logical reasoning activities, Math matters, integration with literature and manipulative. There are mathematics kits to correlate with the Program of Studies (POS) objectives from grades K-6.

Team teaching was encouraged by combining classes to work on special mathematics activities at certain grade levels. Sharing of manipulatives and materials between all grade levels was also encouraged. One of the new educational endeavors at this school had been the mainstreaming of the

learning disabilities students when possible and as needed.

Even with the mathematics revisions and flexibility in teaching strategies, at-risk and targeted students who need it most have not been effected by the alternative approaches.

Problem Documentation

For the past two years, the Math/Science Committee had met to assess the students' performances on mathematics tests. It was documented by the committee that at-risk and targeted students had not performed well on identified mathematics objectives (see Appendix B). Further, teacher surveys collected and compiled after the l990-l99l school year showed deficits/strengths (see Appendix C). These surveys also showed the lack of the usage of manipulatives by teachers in grades 4-6.

Concern parent groups had an effect on curriculum in this community. This is evident in the results submitted by the Citizen's Association (see Appendix A).

Further, individualized tests administered on an individual basis by the school's psychologists and learning disabilities teachers showed academic problems in mathematics. Other techniques for identifying problems of individual students were used. These techniques included the following:

a. Teacher observation of student participation
b. Individual and group discussions
c. Performance with manipulative
d. Written work evaluations
e. Cognitive Abilities Test (CogAt) grades 2 and 4
f. Literacy Mathematics test

Causative Analysis

There are several reasons why at-risk and targeted students in grades 4-6 were not achieving in identified mathematics objectives. One reason is that teachers do not utilize math manipulatives in grades 4-6 to stimulate critical thinking and/or problem solving solutions. This is attributed to the lack of manipulatives at these grade levels. Another reason , as provided by the Math Lead teacher , is that teachers need to familiarize themselves with the proper wording and questioning techniques that are used on standardized tests.

More in-servicing to familiarize teachers on the effectiveness and practicality with the usage of math manipulatives at the intermediate level would be helpful. Further, there are not enough consistent school-wide alternative strategy approaches accessible to teachers. Those alternative strategies, that have been used for at-risk and targeted students, have not been monitored consistently. This is evident by the results of test scores on identified strands that students do not have opportunities to use hands-on materials to explore and solve math problems. Also, time, scheduling and an overwhelming amount of paperwork have limited the amount of time spent in the remediation of the mathematics objectives.

Relationship of the Problem to the Literature

Kamii (l980) states that when teachers succeed in teaching something it is attributed to good teaching. When teachers fail, it is than attributed to the

children not being "ready" or "mature". Kamii (1980) feels that if the cause of teachers' failure is the child/children, then it is necessary to find the cause of success in the child/children.

Nibbelink, Stockdale, Hoover, and Mangru (1987) write that textbook practices significantly and understandably effect achievement in traditional mathematical problem solving. Workbooks provide more work and more collaborative materials. Nibblelink, Stockdale, Hoover, and Mangru (1987) further say publishers are furnishing more manipulatives for stimulating and enhancing problem solving/critical thinking skills.

According to Ornstein and Levine (1989) the causes of the problem were low expectations for low-achieving students, cultural differences, teaching styles and schedules. These problems were indictive throughout their research.

Brookover (1985) states that historically the inferior education provided for minorities and low-socioeconomic status is the result of the ethnic strata/structure in the American society. This is evident in the name changes and lost accents that allowed the early Europeans to assimilate and become a more acceptable entity in the American society.

Croom (1984), in her research, addressed the issue of preparation and high expectations that should be initiated and expected from minority students. The results of her research show that students should not be sorted out or tracked into certain mathematics programs. All students should be encouraged to take mathematics classes. Traditional mathematics programs should be revamped to prepare students for the future.

Comer (1988) feels that Native Americans, Hispanics, and African-Americans have been traumatized the most in their quest for educational equity. Also, educational and economic opportunities have been excluded from these ethnic groups.

The Research Advisory Committee of the National Council of Teachers of Mathematics (1989) writes,

> The social injustices of past schooling practices can no longer be tolerated. Current statistics indicate that those who study advanced mathematics are often white males. Women and minorities study less mathematics and are seriously under-represented in careers using science and technology. Creating a just society in which women and various ethnic groups enjoy equal opportunities and equitable treatment is no longer an issue. Mathematics has become a critical filter for employment and full participation in our society. We cannot afford to have the majority of our population mathematically illiterate. Equity has become an economic necessity. (p. 1)

Further, NCTM (1989) feels that programs that have proven to produce positive effects should be recognized and implemented. Some programs that NCTM has seen as most viable have been the Mathematics Work for Minorities and the Ford Foundation Initiatives.

Williams (1983) feels that too often the measure of student's worth is through the student's performance on standardized tests. Therefore, in a monocultural society minority and low socioeconomic students do not do as well.

Young (1988) reviews the success of urban schools and had found that the success of any student is influenced by the family background. But, he also

asserts that dedication, commitment and structured environments with obtainable goals can have positive implications.

In At-Risk Youth Can Succeed, Green (1989) identifies several alternatives for success of at-risk students. These strategies were increased parent involvement, in-service training for classroom teachers, community partnership with schools and a strong emphasis on teaching students critical thinking/logical reasoning, goal setting and problem solving techniques.

On the other hand, Duran (1989) writes that at-risk Hispanics students cause more culturally-diversed problems. He contends that there should be a better relationship between teacher and students. More emphasis should be placed on the socio-linguistic and cognitive sciences of these students.

Dawson (1987) highlights a school program at his middle school that helps at-risk students. It is noted that the curriculum is accepted by the entire staff. Familiarized identification process, a school-wide discipline program, a homeroom program, and established goals for the school with the removal of labeling and tracking are components that are used effectively.

Schools can meet the needs of at-risk students. This can be done by building on what the student brings to school, enhancing the academic performance, allowing for flexibility in curriculum and continuing to use what has worked in the past for these at-risk students (Cuban, 1989).

The research initiated by Cooper and Speece (1990) identified students at an early age that were considered at-risk, but were in the regular classroom. The most viable aspect of this study was the early intervention strategies before

the potential of school failure.

In 1983, it was reported in the Phi Delta Kappan (1988) that SAT scores were rising for Black students. Researchers looked at the data to find out why. Several reasons were noted. These reasons included more mathematics classes being taken, the attendance of African-American students in private schools, and the influence of African-American students living with higher income parents.

On the other hand, Hispanics students' progress as reported by Phi Delta Kappan (1985) was low. Counselors were less likely to encourage students in math/science classes. Language and low academic expectations were noted.

Flores (1985) views the computer as a means to an end. This is only true where equity in technology is accessible to all. But, he expounds on this contention by stating that minority and low socioeconomic students will suffer, because of the lack of technology in their schools.

Gilbert and Gay (1985) write that the outcomes for African-American children should not differ. The only thing that should change is the means to obtain the outcomes. This is derived, because of the social systems that African-American children live in. This report stated that informal. Cooperative and loosely structured environments were the best academic settings for African-American children.

During the late 1970s and early 1980s a study was done by Johnson (1982) to delve into the reasons for the lag in participation of African-American students in math classes at the middle and high school levels. Johnson (1982)

views the lack of role models, lack of interest, parents who were dysfunctional in mathematics, failure to receive adequate counseling, inability to see the relationship between math and the future and the lack of success in courses taken in mathematics were noted.

Jones, Burton, and Davenport (l984) feel that many variables are attributed to students who do not do well in mathematics. They contend that the average mathematics achievement differs, because of parental contribution, the low expectations of minorities, and courses that minorities are assigned. Their study is noteworthy, because it does provide evidence of relative achievement of African-American children at ages 9 and l3 during the '70s but, as this group became older the variances between age and math achievement differed greatly.

CHAPTER III

ANTICIPATED OUTCOMES AND EVALUATION INSTRUMENTS

Goals and Expectation

The goal of this practicum was to improve mathematics achievement of at-risk and targeted students in grades 4-6 through the use of manipulatives..

Behavioral Objectives

The following objectives were projected for this practicum:

Objective 1 At the end of the eight month implementation, half of the 65 at-risk and targeted students would show improvement in identified mathematics objectives, as determined by the comparison of students' 1991-1992 POS mathematics results to their 1990-1991 test scores.

Objective 2 At the end of the eight month implementation, half of the 65 at-risk and targeted students would show improvement on identified mathematics objectives, as determined by their second and fourth quarter report card grades (see Appendix D).

Objective 3 At the end of the eight month implementation, half of the 65 at-risk and targeted students would improve on identified mathematics objectives, as determined by data collected from the end of the year survey (see Appendix E).

Objective 4 At the end of the eight month implementation, half of the 65 at-risk and targeted students would improve in mathematics as determined in the use of math manipulatives (see Appendix F).

Objective 5 At the end of the eight month implementation, 4 out of 7 teachers would be able to use math manipulatives to effectively help at-risk and targeted students in identified math objectives (see Appendix H).

Measurement of Objectives

Objective one was measured by the comparison of the 1991-1992 POS Mathematics scores and those results of the 1990-1991. The teachers met with the writer monthly to discuss problems and/or successes.

Objective two was measured by the data collected from the second and fourth quarter report card grades (see Appendix D).

Objective three was measured by the number of parent survey sheets collected that indicated successes or failures (see Appendix E)

Objective four was measured by a table that would indicate the frequency and the of manipulatives used to help at-risk and targeted students in grades 4-6 (see Appendix F).

Objective five was measured by a teacher questionnaire collected at the end of July (see Appendix H).

CHAPTER IV

SOLUTION STRATEGY

Discussion and Evaluation of Possible Solutions

The problem that exited in this writer's work setting was to improve mathematics achievement of at-risk and targeted students in grades 4-6 through the use of manipulatives.

In Class, Race, and Achievement, Ornstein and Levine (1989) contended that when low-achieving students reach upper-elementary grades or junior high school, they are required to do very little. The authors say in order for success to be achieved, teachers should use effective strategies such as wait-time, direct and explicit instruction, cooperative learning and mastery learning approaches.

On the other hand, Cuban (1989) recommended that schools make a commitment to at-risk students. Cuban (1989) views cooperative learning approaches that target culturally different students as a necessary entity in the academic success of students.

The research initiated by Kamii and DeVries (1980) contended that children develop socially, morally, and cognitively, but also, politically and emotionally through activities involving rules and strategies. Further, Kamii and DeVries (1980) state that developing children's autonomy (self) will help solve the problem that scientific theory has not been able to reach.

Researchers do agree that learning styles and under-achievement have

always been integral parts of every school district. Although, many alternative approaches were presented in these articles, researchers felt that collaborative teaching methods, cooperative learning methods, and peer tutoring can be effective approaches. In summary, the consensus is that in order for any method to work, there are at least three specific variables needed. These variables are that students needed a strong sense of self (autonomy), structured environments, and alternative learning approaches.

Atwater (l986) stated there is a need for improvement in science and mathematics education in America. Further, Atwater (l986) stated that this concern for improvement includes the minority population such as African-Americans, Hispanics, and American Indians who are only making slow progress in this field. Atwater (l986) contended that minority students do not have to become scientists or engineers, but need to become more science and math literate.

Beckwith (l988) is concerned about students with culturally diverse and disadvantaged background. She feels that instead of focusing on the programs, teachers should direct their energies toward reaching and establishing a productive environments that allows hidden potential to emerge. One solution that Beckwith (l988) has developed and implemented is the High Potential Pilot (HPP) program. This curriculum model of this program emphasized the extension of academic skills in math and language arts. It also allowed for enrichment in the content areas. One focus of the enrichment in the content areas was on raising the self concept of the participants. Hands-on

activities were used in the HPP program of these culturally diverse and disadvantaged population to stimulate critical thinking and logical reasoning skills.

Comer (1986) stated that one solution in improving students' achievement is to help parents of low-income students work collaboratively with a core team. This core team led by the principal would establish a governance and a management group. This core team's goals would be to improve the climate, the academic program, and staff development.

Walker (1987) saw that the new thrust of obtaining mathematics competency for at-risk and targeted students is through computer-based educational programs. Further, she stated that early evaluations of the effectiveness of the computer-based program has indicated that the program has had positive impact. The computer-based program is designed theoretically on the insights of the cognitive development insights of Piaget and Brunner (structuralism) and the operant conditioning as seen by Skinner. This program allowed the teacher time for the development of higher level instruction and provides opportunities for creativity and innovation within the curriculum.

The findings of Wells (1984) in the Kentucky Five Year Plan- Section 29D3 noted significant growth, because of the individualize tutorial program. It was noted in this study that many of the students selected were in remedial classes, but had never received individual assistance. Students reactions in this program were also positive. Many students felt that the individualized program helped them to group concepts better. Attendance at school was

higher during the days of tutoring. Students felt better about themselves. Finally, an array of materials was used to teach the concept.

Cole (1987) contended that the relationship between the home and ethnic communities is strained. Schools that minority children attend should foster positive attitudes toward academic success. Cole (1987) saw the insensitivity of the educational system toward these ethnic cultures. Effective involvement was an important factor in the success of minority students. Her solutions included participation in professional development activities. This enabled parents to enhance their skills and techniques to help their children.

Williams (1983) contended that biases against certain ethnic cultures had always been evident on standardized tests. Her assumption was that minority aspects should be incorporated in the development of these tests. Further, she assessed that achievement rather than intelligence should be the focus of these tests.

Young (1988) felt that all students can learn. Evidently, there is a greater need for more emphasis on math and science. His contentions are that students have greater success where there is strong administrative leadership, a positive school climate, total school instructional emphasis, and on going assessment.

NCTM (1989) have established standards that focuses on those students that are at-risk. Their program research advisory team felt that programs that have positive impact on under-served and under-represented groups such as the Making Mathematics Work for Minorities project and the Ford Foundation

Initiatives. Their goal was to incorporate women researchers and minority researchers from minority institutions. This should be included in the cadre of legitimate researchers. There is still not enough information to specifically state what is best. But early intervention and getting to children before they enter the mainstream of mathematics was the focus.

Catello and Peck (l990 reported that at-risk students can do well if the emphasis is placed on life skills. These life skills included critical thinking and problem solving techniques.

In Project Ride, Beck and Weast (l990) related that this is a teacher supported project. Its focus was to help at-risk and atypical learners. The methods that were used were virtually through the resources and proven methodology that classroom teachers already practice.

In contrast, Cummins (l986) felt that minority students throughout the world are intimidated by the power exerted upon them by the majority. He considers this a problem that enables and enhances failure in these groups. He views the improvement of minority students in the direction of academic curriculum and the revisions of policy procedures..

Cuban (l989) contended that schools have a commitment to at-risk students. Schools should web together cultural and personal knowledge of and about each individual student. Furthermore, Cuban (l989) felt that teachers who use direct instruction and active teaching styles in math at certain elementary grades indicate increased achievement in test scores. He viewed that cooperative learning approaches that target culturally different children have

demonstrated an array of positive outcomes indicating test score gains.

Slavin (1988) believed that cooperative learning offered alternatives to ability grouping, pull-out programs, and special education. Cooperative learning methods are means of introducing higher-level skills into a curriculum, of ensuring students an adequate level of basic skills, and of giving students the collaborative skills needs to develop interdependently in society.

Other perspectives addressed by Murr (1989) and Kanter (1990) in their articles was a correlation between self pacing, vicarious experiences and math manipulatives. These techniques proved to be most effective.

According to Thompson and Rathmell (1988) the establishment of a set of mathematics standards should be an integral part of any school district. These standards would be the basis for math proficiency and achievement.

The writer believed that many of the solutions offered in the literature can be implemented with the designated population and in the writer's work setting. The solutions assisted the writer in providing some school-wide alternative strategies for success in mathematics for at-risk and targeted students.

Description and Justification for Solutions Selected

The literature provided a number of suggestions and alternative approaches to improve mathematics achievement for at-risk and targeted students. Cuban (1989) contended that schools that have committed themselves to at-risk students have had positive outcomes. He viewed that cooperative learning approaches that targeted culturally different students have

provided an array of positive outcomes that are indicated in the students' higher test score gains and greater self-esteem.

Slavin (1989) believed that cooperative learning offered alternatives to other remedial and special education programs. In his opinion, cooperative learning methods and peer mentoring/tutors are means of introducing higher-level skills into a curriculum, of ensuring students an adequate level of basic skills, and of giving students the collaborative skills needed to develop interdependently in society.

On the usage of mathematics manipulatives Murr (1980) and Kanter (1990) contended that there was correlation between self pacing and vicarious experiences. The use of manipulatives enhanced the vicarious experiences and recreated real life experiences.

On the other hand, this supported Young's (1988) position that there should be on going and continuous assessment of at-risk and targeted students. It was felt and realized that consistency and continuity were necessary in the life of a at-risk and/or targeted student.

Cole (1987) stated that there should be effective involvement by parents. Parents should be an integral part of the student's academic performance. The teacher made manipulative packets empowered the parent and gave them ownership and a greater sense of responsibility in their child's academic success in mathematics.

In contrast, Lee (1984) wrote of her success with at-risk students in mathematics. The success of her research was due in part to the student's

discovery of computers. Lee (1984) retorted that so many students entered into her program with extra "baggage" (social and emotional problems). The computers afforded these at-risk students an opportunity to achieve success in a non-threatening environment.

The solution plan the writer used included the following elements; cooperative learning (Cuban, 1989), peer tutoring (Slavin, 1989), the use of math manipulatives as recommended by the research done by (Murr, 1980) and (Kanter, 1990), mathematics assessment surveys (Young, 1988), and parent involvement (Cole, 1987). Computer usage (Lee, 1984) was also selected because it afforded the at-risk and targeted students immediate feedback and reinforcement of identified mathematics objectives/strands.

With the 4-6 core team of teachers and peer tutors, at-risk and targeted students' mathematics strengths and weaknesses were consistently assessed and reinforced. Teachers and parents benefited from these solutions, because it provided teacher made manipulatives and assessment throughout the school year and during the summer to the at-risk and targeted students. These teacher-made manipulatives provided the reinforcement of objectives at school and at home.

The writer felt that the solutions selected addressed the problems and the causes of the problems. It is also felt that the solutions mentioned achieved the stated objectives.

Report of Action Taken

The solution implementation strategy for the practicum began after receiving approval in December 1991 to begin the implementation phase of the practicum.

Once this approval was obtained, the principal of the elementary school was consulted regarding permission to implement this practicum. The solution strategy for this practicum began with an informal presentation on December ll, l99l.

The first step of the solution strategy was the presentation of an in-service to the 4-6 core team of teachers. A list of the identified at-risk and targeted students were given to each member of the core team of teachers. The teachers were given an overview of the practicum problem, the solution strategies and the writer's calendar plan for the eight month implementation. The calendar plan enabled the teachers to gleam the schedule of activities by the month. Emphasis was placed on "Math Month" and the month when the standardized test would be administered. They were informed of their respective roles in the implementation of the strategy solutions. The 4-6 core team of teachers were informed of the processes that would and could be used to monitor the progress of the at-risk and/or targeted students. All the necessary forms that would be used during the implementation period were given to the team (see Appendices B, C, D, and F). A question and answer period followed the presentation to clarify any anticipated concerns/problems.

The second step of the solution strategy was the presentation of the manipulatives available to the 4-6 core team of teachers. These manipulatives were packaged and placed in individual grade level boxes. This made it easier for the 4-6 core team of teachers to identify. Then, the teachers participated in several hands-on practical application activities that used the manipulatives. The activities addressed the areas in the mathematics strands/objectives where the at-risk and targeted students had the greatest deficits.

The third step of the solution strategy was to locate a school bulletin board for students and teachers to see and to use. This was done to reinforce the use of manipulative ideas. A memo was issued monthly that offered helpful solutions to mathematics problems generated from the teachers and to update the 4-6 core team of teachers of the progress/problems that was being made.

The fourth step of the solution strategy was to provide the assessment checklist. This checklist would enable the teachers to record the services provided for at-risk and targeted students or to request further assistance if needed (see Appendix C).

The fifth step of the solution strategy was to meet with the peer tutors. The peer tutor group was comprised of ten responsible students that all volunteered to work with other students in mathematics. The writer met monthly or as needed with the group. Peer tutors were selected because of their ability to work well with other students without ridicule. Peer tutors had fifteen minutes at the end of each mathematics class period to work with the at-risk and targeted students. The peer tutors would review with these students mathematics objectives/strands that were confusing or were difficult. Peer tutors were encouraged to use the manipulatives provided to the 4-6 core team of teachers to solve mathematics problems. The teachers noted that the peer tutors were respected by the at-risk and targeted students. Discipline was better and the at-risk and targeted students were treated as an integral part of the class and the school.

The sixth step of the solution strategy was to send home a letter informing the parents of the summer manipulative packets and a meeting to familiarize the parents with the manipulatives that would be used. In June, an informal meeting was given after school for the parents that would be involved in the summer project. At this meeting, stations of manipulative activities were set up in the library and the resource room. Parents and volunteer 4-6 core teachers actively engaged in problem solving/critical thinking skill activities using the manipulatives from the summer packet. Items from the teacher-made manipulative sheet were used (see Appendix F). At the end of the meeting, parents were told that an assessment sheet would be given to them at the end of the summer to summarize their feelings/problems with the summer packets and activities (see Appendix E).

The seventh step of the solution strategy was to provide teacher-made manipulatives to the at-risk and targeted students during the summer. Each of the at-risk and targeted students were given a student packet of manipulatives and a letter to the parent explaining how they would be able to assist the student during the summer. Parents were instructed to work with the student each week using the manipulatives. Each student's packet addressed those mathematics strands/objectives that the student needed reinforcement or more practice. Parents would initial the weekly activity sheet and return them to the writer in the self addressed envelope provided or place them in the writer's school mailbox. If the parents were not able to complete all the activities of one week, they could incorporate them into the next week's activities as well.

Many of the at-risk and targeted students were participants in the summer school program. This helped the writer to collect the weekly activity slips and replenish manipulatives if needed and when necessary. These teacher-made manipulatives provided reinforcement of objectives at school and at home.

The final step of the solution strategy was to collect and analyze parent and teacher surveys (See Appendices E and H). These surveys were collected at the end of August and the summer school program. Parents and teachers were encouraged to write in comments that would assist the writer in improving the practicum.

During the eight month implementation phase of this practicum there was one deviation from the writer's plans. This unexpected event was the restraint placed on the writer with regards to the use of paper for the memos. However, paper was donated to the school by Xerox. This alleviated the paper problem.

CHAPTER V

RESULTS, DISCUSSION, RECOMMENDATIONS, AND DISSEMINATION

Results

The problem that existed in this writer's work setting was to improve mathematics achievement of at-risk and targeted students in grades 4-6 through the use of manipulatives.

The solution to the problem was an effective in-service to introduce appropriate use of manipulatives, peer tutoring, collaborative teaching methods and computer use. Monthly meetings, manipulative bulletin board activities, and the recognition of a month during the school year as " Math Month " were also effective strategies. These solutions provided the tactile-kinesthetic materials for the minority students who were the greatest number of at-risk and targeted students at the writer's school.

The goal of this practicum was to improve mathematics achievement of at-risk and targeted students in grades 4-6 through the use of manipulatives.

Specific objectives were designed to achieve these goals. The following will be a list of each objective followed by the results related to that specific objective.

Objective 1 At the end of the eight month implementation, half of the 65 at-risk and targeted students would improve in identified mathematics

objectives, as determined by the comparison of students' 1991-1992 POS mathematics results to their 1990-1991 test scores.

During the eight month implementation, the core team of teachers received the names of the students who had scored below average on the Mathematics POS (Program of Studies) Table 4 provides an illustration of the results for this objective.

Table 4

Comparison of 1990-1991 POS Mathematics Test Scores to 1991-1992

Total Number of Students Tested = 65

	1990-1991		1991-1992		
Fourth Grade	below average	at or above average	below average	at or above average	change
N=20	20	0	6	14	+14
Fifth Grade N=25	25	0	10	15	+15
Sixth Grade N=20	20	0	3	17	+17

The results of Table 4 indicated the total number of at-risk and targeted students that were administered the Mathematics POS (Program of Studies) in 1990-1991 and 1991-1992. It should be noted that 77% of the students that took the test improved.

Objective 2 At the end of the eight month implementation, half of the 65 at-risk and targeted students would improve on identified mathematics

objectives, as determined by their second and fourth quarter report card grades (see Appendix D). Table 5 summarizes the results for this objective.

Table 5
Comparison of the Second and Fourth Quarter Report Card Grades

Number of Students = 65

Grade	Second	Fourth	2nd/4th Comparison
A	0	0	0
B	37	53	+16
C	23	10	-13
D	5	2	-3

The results of table 5 indicated that at-risk and targeted students did improve. This is indicated by the increase in the number of students receiving higher letter grades in the fourth grading period .

Objective 3 At the end of the eight month implementation, half of the 65 at-risk and targeted students would improve on identified mathematics objectives, as determined by the data collected from the end of the year parent survey (see Appendix E).

Table 6
Parent Survey

Total Number of Parents = 50

	To a small degree 1	2	3	To a great degree 4	5
1. I am aware of the content of the mathematics program.	0	0	0	30	20
2. The surveys offered me an opportunity to monitor my child's progress	0	0	15	20	15
3. The surveys helped me to communicate with my child about mathematics.	0	0	29	21	0
	Of little value 1	2	3	Of much value 4	5
4. I felt the overall value of the surveys were	0	0	10	15	25

The results of table 6 indicated that overall most of the parents surveyed were satisfied with the mathematics program. Parents also indicated to the writer that they valued the communication between the school and the home.

Objective 4 At the end of the eight month implementation, half of the 65 at-risk and targeted students would improve in mathematics as determined in the use of math manipulatives (see Appendix F). Tables 7 and 8 summarize the manipulatives/strategies used and the frequency in which each teacher used the manipulatives.

Table 7

Mathematics Manipulatives/Strategies Used

	computers	peers	manipulatives	other
Teacher 1	x	x	x	x
Teacher 2	x	x	x	
Teacher 3	x		x	
Teacher 4	x		x	
Teacher 5	x	x	x	x
Teacher 6	x		x	x
Teacher 7	x	x	x	

The results of table 7 indicated that manipulatives were used by the core team of teachers. Four of the seven teachers indicated that the use of peer tutors were very effective, because it enhanced the at-risk and targeted students' self-esteem. Discipline was better. Because of accessibility, manipulatives and computers were used by all the teachers. It should be noted that other strategies were also used to help the at-risk and targeted students.

Table 8
Frequency of Manipulatives Used

	daily	weekly	monthly	as needed
Teacher 1		x		
Teacher 2	x			
Teacher 3		x		
Teacher 4		x		
Teacher 5		x		x
Teacher 6		x		
Teacher 7		x		x

The results of table 8 indicated that manipulatives were used by every teacher on the core team of teachers weekly. They also indicated that the core team of teachers utilized the manipulatives available to them.

Objective 5 At the end of the eight month implementation, 4 out of 7 teachers would use math manipulatives to effectively help at-risk and targeted students in identified math objectives (see Appendix H). Table 9 summarizes the results from the teachers.

Table 9

Teacher Survey

Total Number of Teachers Surveyed = 7

	To a small degree				To a great degree
	1	2	3	4	5
1. I was aware of the mathematics objectives that needed to be covered during the school year.	0	0	0	7	0
2. The manipulatives provided were useful.	0	0	0	0	7
3. I was able to use most of the teacher made manipulatives.	0	0	6	1	0
4. I felt the use of the manipulatives should be covered.	0	0	0	0	7
5. Students benefited from the use of manipulatives.	0	0	0	0	7
6. I was able to use teacher made manipulatives weekly.	0	0	0	0	7

The results of table 9 clearly supports the writer's solution for objective 5. All teachers indicated positive results.

Discussion

A review and interpretation of the data suggests that all five objectives were achieved, indicating that the goal of improving mathematics achievement of at-risk and targeted students in grade 4-6 through the use of manipulatives was achieved.

The results confirmed the writer's expectations that the use of manipulatives in this school could assist at-risk and targeted students in grades 4-6. The use of manipulatives enabled teachers to help at-risk and targeted students who were experiencing difficulty in mathematics.

A review of the literature revealed that others have met similar positive results in utilizing the solutions chosen by the writer. The research initiated by Irvine (1988) on relevant factors that work in urban schools identified the effective strategies that had been used by teachers in the classroom to produce and to generate academic success in mathematics for at-risk and targeted students. The most viable aspects of academic success in mathematics for at-risk and targeted students addressed in her article were the specific policies and the procedures set by the school's administrators. Her results were positive.

Johnson (1984) stated that parents, relatives, friends and teachers play a major role in the success of at-risk students in mathematics. His research conveyed that early intervention and remediation with the use of manipulatives and peers have assisted at-risk students. These strategies have helped these students realize success in mathematics. Further, Johnson (1984) contended

that collaborative teaching and technology have proven to be effective strategies.

Further, data provided by Jones, Burton and Davenport (1984) implied that new instruments designed to meet the particular needs of students were the most useful.. These instruments generally were teacher-made and tactile kinesthetic in nature. Age appropriateness and conducive to the learning styles and the environment of the targeted students were the advantages of these teacher-made manipulatives.

The trend towards the adoption of computer-based instruction was recognized by Walker (1987). Her research proved that computer usage provided advantages for at-risk students in mathematics. Those attributes which Walker (1987) found to be true also surfaced at the writer's school. These attributes were:

a. frequent feedback to the students
b. tutorial relationships
c. individual programming
d. individual pacing
e. motivational factors
f. task-orientated instruction for improving learning

Walker (1987) viewed the computer as displaying versatility in on-line drill and practice, giving immediate feedback, and assigning remediation. Because of the positive attributes of the computer, teachers were provided additional instructional time to create opportunities for other innovative curriculum. This

integration provided materials that could be used in conjunction with other academic disciplines.

Olion and Olion (l984) reported that students who are labeled as learning disabled are often poorly accepted, or rejected, by their peers. Development of adequate alternative approaches and the use of peers have been used successfully to assure academic success for these students. In comparison to the work of others, this writer achieved similar positive results.

The most important implication flowing from the success of this practicum is the administrator's desire to continue the program at the level at which it is functioning. In-service training will be provided to newly employed classroom teachers and aides when necessary and when needed.

Recommendations

1. It is recommended that any replication of this practicum be implemented biennially. This will enable the teachers to follow the at-risk and targeted students for a longer period of time in order to produce the best results.

2. It is recommended that the Math/Science committee use the results of this practicum as part of its (OP) operating plan in the school.

3. It is recommended that a new grade level should be added each year so that all identified at-risk and targeted students in grades 1-6 will benefit.

Dissemination

The writer will share this practicum's results with the area superintendent and her principal. The writer will submit copies of the practicum to the Research

and Evaluation Team in her school district and, the Math/Science committee at her school.

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APPENDIX A
REPORT OF ASSOCIATION

Resolution on School Test Scores

Whereas, there are a number of disturbing trends in the 1990 Iowa Test of Basic Skills Scores for all County Public Schools.

Whereas, countywide, there are apparent weaknesses in the scores of vocabulary and reading comprehension at all school levels, as well as weakness in language skills and science in the elementary school, and are generally below basic ability scores.

Whereas, in 1987 and 1988, county students scored above 5 points higher on the achievement tests than they did on the ability section, while this year elementary students scored an average of 2 points lower, a trend toward underachievement which must be reversed.

Whereas, six of the ten elementary schools with the lowest composite achievement scores are in Area I, and five of them are feeder schools.

Whereas, two intermediate schools ranked 20th and 21st respectively among the 22 county intermediate schools, two high schools ranked 22nd and 23rd among the 23 county high schools in terms of achievement scores.

Whereas, the decline in one high school's ranking is especially disturbing, since it ranked tenth in 1987 and sixteenth in 1988, and because its achievement scores are lower than its ability scores.

Whereas, average achievement scores for Area I elementary schools declined from 65.4 in 1988 to 61.6 in 1990, while ability scores increased from 59.5 to 65.4 a disturbing trend which calls into question the basic assumption held by many that perceived declines in educational quality in this area are due to demographic factors.

Whereas, we are concerned by these trends affecting our local schools, as well as those that seem to be more widespread. The perception that educational quality in this area is declining, which seems to be supported by the objective data, is causing parents arriving in this area to seek other areas of the county, adversely affecting the marketability of homes in this area, and is also driving parents to withdraw their children from the local public schools. If not arrested or reversed in the near future, this trend will inevitably lead to further declines in the local schools test scores.

Therefore Be It Resolved that the Citizen's Association urges the School Board and the Superintendent of the County Public Schools take immediate, positive, and affirmative action to address the countywide decline in achievement scores, with emphasis on the specific areas of weakness noted above.

Be It Further Resolved that the Council of Citizen's Associations urges the School Board Representative and the Area 1 Superintendent take immediate, positive, and affirmative action to arrest the decline of school test scores in the schools in and near the District, and to make those schools more attractive and better suited to the educational needs of residents of this area.

Area I Schools

9/2/90

SRA	1987 Ability	Rank	1988 Iowa	Rank	1990 Comp	Iowa Ability	Rank	Enrollment 1988	1989	Black	Hispanic
77	65	72	61	103	59	62	104	420	398	107	70
65	66	108	62	98	57	62	108	495	479	61	23
79	79	62	71	65	72	77	53	406	380	41	12
85	79	23	60	16	68	68	72	249	277	36	15
59	47	111	46	114	52	44	117	277	253	83	36
71	66	93	68	76	72	69	53	509	584	75	30
61	65	114	CLOSED				NA				
63	61	112	63	95	57	59	108	611	603	143	28
65	55	108	64	89	55	57	112	448	416	131	26
		NA		NA			NA	344	318	101	21
		NA		NA			NA	261	246	72	26
74	71	81	77	30	80	79	48	552	584	96	14
		NA		NA	67	72	78	544	657	65	11
82	82	41	75	50	76	76	48	834	821	67	22
57	63	102	66	84	65	68	68	119	453	42	39
89	79	6	83	7	63	65	94	326	275	12	13
80	74	56	70	69	67	64	78	496	582	37	29
		NA		NA	67	72	78		922		
73	69	83	59	106	65	66	88	718	404	32	43
69	69	100	65	86	66	76	86	455	229	25	18
72	69	88	72	60	62	65	97	445	465	97	24
67	62	102	67	79	60	58	94	647	655	236	41
62	53	111	45	116	40	40	124	430	420	241	44
67	64	102	58	107	62	68	97	598	594	182	28
59	64	115	56	109	48	51	121	491	476	172	27
80	66	56	64	89	52	56	117	515	520	196	43
84	79	29	82	13	71	77	63	520	535	17	37
79	76	62	77	30	67	70	78	468	487	109	11
79	70	62	62	98	55	63	112	681	707	187	102
82	79	41	76	45	67	71	78	491	457	109	10
59	53	115	46	114	40	40	124	336	305	95	31
70	68	95	63	95	77	61	30	337	371	81	26
55	58	118	54	111	45	50	100	358	404	170	15

BEST COPY AVAILABLE

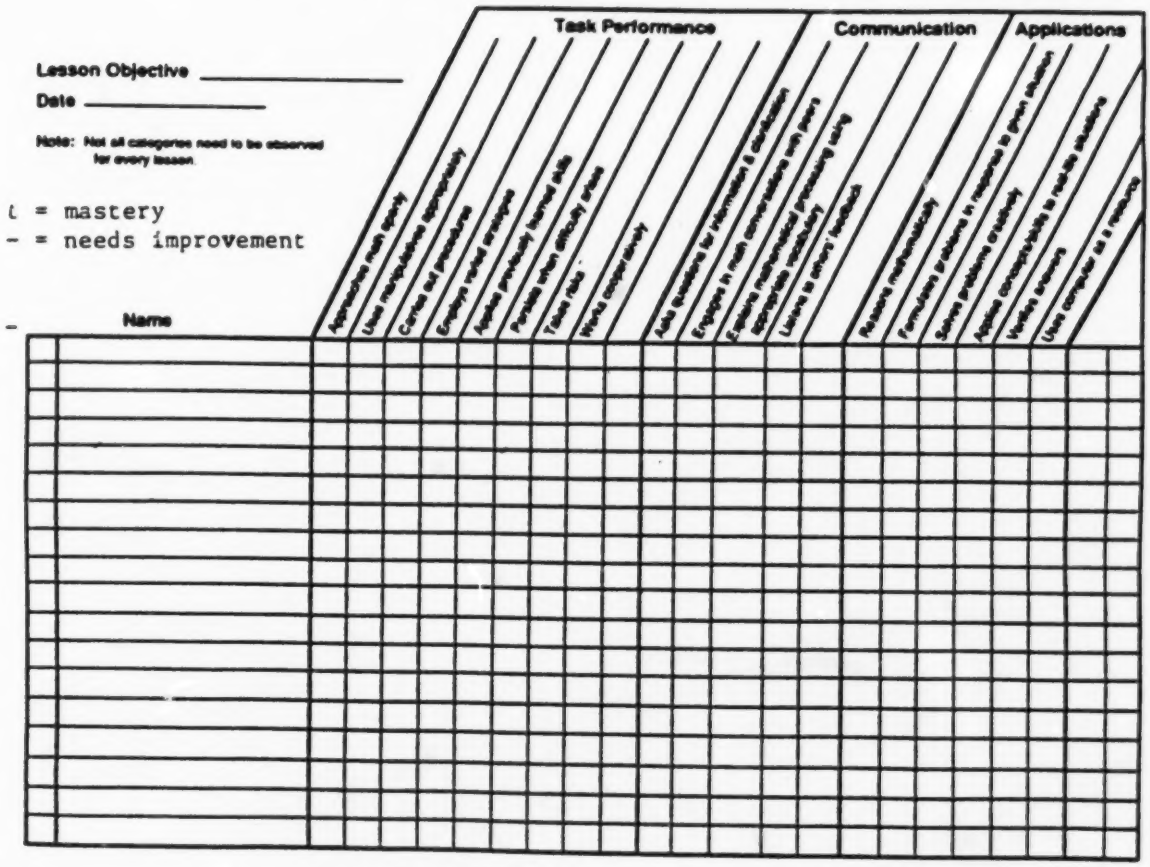
APPENDIX B
STRENGTHS AND WEAKNESSES

Lesson Objective _____

Date _____

Note: Not all categories need to be observed for every lesson.

t = mastery
– = needs improvement



APPENDIX C
TEACHER SURVEY

ELEMENTARY SCHOOL

Remedial Instruction

Teacher _____

Grade _____

Year _____

Student Name	Subject	Identification							Services														
		Teacher Judgement	Instructional Level	Standardized Test(s)					ESL	Reading Teacher	Parent Tutors	Instructional Ass'ts (Includes Computers)	Peer Tutoring	Cross-Age Tutoring	Coop. Learning	Alt. Approaches	Alt. Materials	Mentoring	Computer Remediation				
	Reading																						
	Math																						
	Lang/Writ																						
	Reading																						
	Math																						
	Lang/Writ																						
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APPENDIX D
QUARTERLY DATA COLLECTION SHEET

To: Classroom Teachers in Grades 4, 5, and 6

From: Veronica A. Bryant

Re: Report Card Grades (Mathematics)

In order for me to assess the progress of At-Risk and Targeted Students in your classroom, I will need your cooperation. Please list the identified students number and grades for the second and fourth quarter.

Number	2nd Q	Comments	4th Q	comments
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
1				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				

APPENDIX E
PARENT SURVEY

PARENT SURVEY

Thank you for the input you gave throughout the year by responding to the mathematics surveys. This information became an important resource in evaluating your child's needs and progress. Please take a moment to complete this questionnaire and return it to school at your earliest convenience.

Again, I thank you for your continued support and participation.

Sincerely,

1. I am aware of the content of the mathematics program.

1	2	3	4	5
To a small degree				To a great degree

2. The surveys offered me an opportunity to monitor my child's progress.

1	2	3	4	5
To a small degree				To a great degree

3. The surveys helped me to communicate with my child about mathematics.

1	2	3	4	5
To a small degree				To a great degree

4. I felt the overall value of the surveys was

1	2	3	4	5
Of little value				Of much value

Comments:

Name (optional) _____ Date _____

APPENDIX F
LIST OF TEACHER-MADE MANIPULATIVES

CURRENT LIST OF TEACHER-MADE MANIPULATIVES

NOVEMBER 1991

number lines

peas and beans

marbles

toothpicks

pipe cleaners

cloth numbers

macaroni

popsicle sticks

laminated bingo boards

laminated multiplication charts

Materials above will be used to improve critical thinking and problem solving skills of the at-risk and targeted students.

Objectives to be monitored are:

1. geometry
2. metric system
3. mental math
4. data analysis, statistics, and probability

APPENDIX G
LOG OF UNEXPECTED EVENTS

LOG OF UNEXPECTED EVENTS DATE

APPENDIX H
TEACHER QUESTIONNAIRE

TEACHER QUESTIONNAIRE

Thank you for the input you gave throughout the school year. Please take a moment to complete this questionaire.

Again I thank you for your continued support and participation.

Sincerely,

1. I was aware of the mathematics objectives that need to be covered during the school year.

1	2	3	4	5
To a small degree				To a great degree

2. The manipulatives provided were useful.

1	2	3	4	5
To a small degree				To a great degree

3. I was able to use most of the teacher made manipulatives.

1	2	3	4	5
To a small degree				To a great degree

4. I felt the use of manipulatives should be continued.

1	2	3	4	5
To a small degree				To a great degree

5. Students benefited from the use of manipulatives.

1	2	3	4	5
To a small degree				To a great degree

6. I was able to use teacher made manipulatives weekly.

1	2	3	4	5
To a small degree				To a great degree